Global Hydrology Resource Center

Data User Guide

P-3 Meteorological and Navigation Data IMPACTS

Introduction

The P-3 Meteorological and Navigation Data IMPACTS dataset is a subset of airborne measurements that include GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements of temperature, pressure, water vapor, and horizontal winds. These measurements were taken from the NASA P-3 aircraft during the Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) campaign. Funded by NASA's Earth Venture program, IMPACTS is the first comprehensive study of East Coast snowstorms in 30 years. The campaign aimed to (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. Data are available in ASCII-ict format from January 12, 2020 through February 26, 2020.

Citation

Yang-Martin, Melissa and Joseph Ryan Bennett. 2020. P-3 Meteorological and Navigation Data IMPACTS [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/IMPACTS/P3/DATA101

Keywords:

NASA, GHRC, IMPACTS, P-3, snowstorm, navigation, airborne measurements, potential temperature, relative humidity, wind speed, wind direction, atmospheric temperature, atmospheric pressure

Campaign

The Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening

Snowstorms (IMPACTS), funded by NASA's Earth Venture program, is the first comprehensive study of East Coast snowstorms in 30 years. IMPACTS will fly a complementary suite of remote sensing and in-situ instruments for three 6-week deployments (2020-2022) on NASA's ER-2 high-altitude aircraft and P-3 cloud-sampling aircraft. The first deployment began on January 17, 2020 and ended on March 1, 2020. IMPACTS samples U.S. East Coast winter storms using advanced radar, LiDAR, and microwave radiometer remote sensing instruments on the ER-2 and state-of-the-art microphysics probes and dropsonde capabilities on the P-3, augmented by ground-based radar and rawinsonde data, multiple NASA and NOAA satellites (including GPM, GOES-16, and other polar orbiting satellite systems), and computer simulations. IMPACTS addressed three specific objectives: (1) Provide observations critical to understanding the mechanisms of snowband formation, organization, and evolution; (2) Examine how the microphysical characteristics and likely growth mechanisms of snow particles vary across snowbands; and (3) Improve snowfall remote sensing interpretation and modeling to significantly advance prediction capabilities. More information is available from NASA's Earth Science Project Office's IMPACTS field campaign webpage.

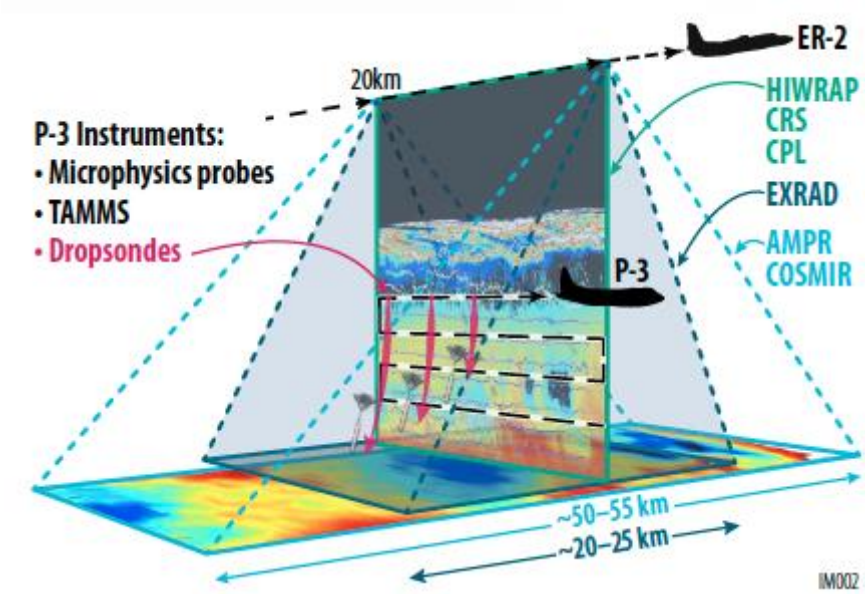

Figure 1: IMPACTS airborne instrument suite
(Image source: NASA IMPACTS ESPO)

Instrument Description

This dataset was collected by instruments onboard The NASA P-3B aircraft. The instruments include:

(1) Litton LN-25 Embedded Inertial Navigation System: provides high precision and accuracy GPS positioning and aircraft orientation.

(2) Rosemount Total Air Temperature (TAT) probe: immersion sampling of the total air temperature of the airstream along the aircraft skin.

(3) Edgetech three-stage chilled mirror hygrometer: immersion sampling of the airstream along a chilled mirror in which the temperature of condensation or deposition is recorded.

(4) Heitronics KT-19.85II Infrared Pyrometer: infrared retrieval of surface temperature.

(5) APN232 Radar Altimeter: measures the height of aircraft above surface topography.

NASA's P-3B is a four-engine turboprop, capable of long duration flights of 8-12 hours and is based out of NASA's Wallops Flight Facility in Wallops Island, VA. The P-3B aircraft is ideally suited for low altitude heavy lift airborne science missions. The NASA P-3B has a long history of supporting cryosphere studies. Further information on the NASA P-3B can be found at NASA P-3B Airborne Laboratory.

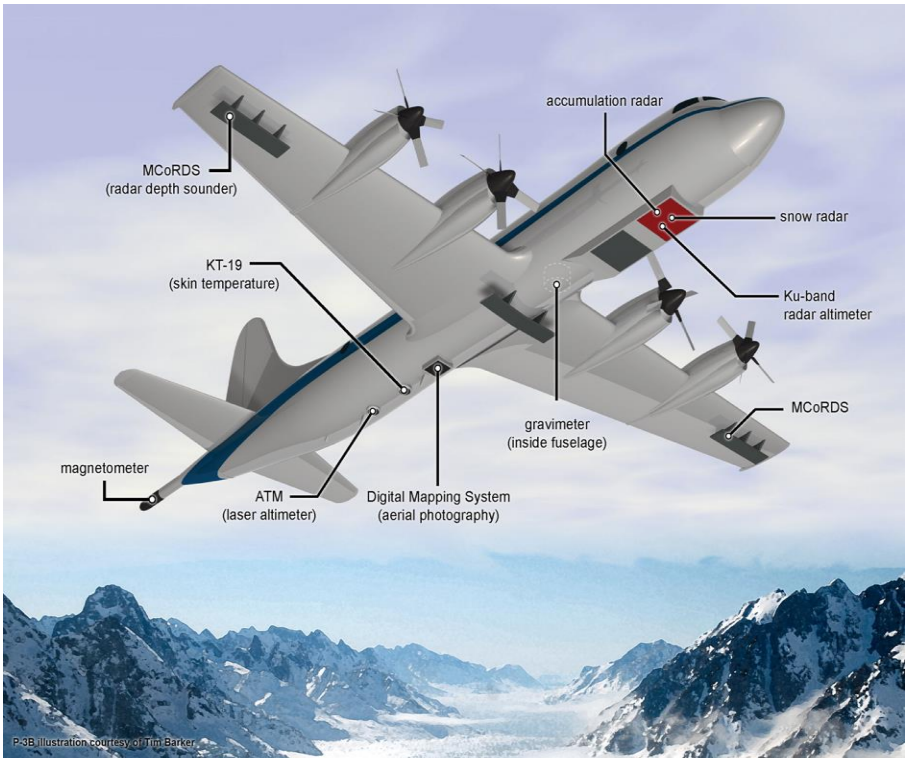

Figure 2: NASA P-3B Airborne Laboratory.
(Image Source: NASA P-3B Airborne Laboratory)

Investigators

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Data Characteristics

The P-3 Meteorological and Navigation Data IMPACTS contains airborne measurements taken from NASA's P-3B aircraft during the IMPACTS field campaign. Data files are in ASCII-ict format at a Level 2 processing level. More information about the NASA data processing levels is available on the EOSDIS Data PRocessing Levels webpage.

Table 2: Data Characteristics

Characteristic	Description
Platform	NASA P-3B aircraft
Instrument	Litton LN-25 Embedded Inertial Navigation System; Rosemount Total Air Temperature (TAT) probe; Edgetech three-stage chilled mirror hygrometer; Heitronics KT-19.85II Infrared Pyrometer; APN232 Radar Altimeter
Spatial Coverage	N: 45.250, S: 33.261, E: -70.193, W: -90.439 (Eastern United States)
Spatial Resolution	5m
Temporal Coverage	January 12, 2020 - February 26, 2020
Temporal Resolution	Hourly -< Daily
Sampling Frequency	1 second
Parameter	GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements (temperature, pressure, water vapor, and horizontal winds)
Version	1
Processing Level	2

File Naming Convention

The P-3 Meteorological and Navigation Data IMPACTS dataset files are in ASCII-ict format and have the following naming convention:

Data files: IMPACTS_MetNav_P3B_YYYYMMDD_R0.ict

Table 3: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month

DD	Two-digit day
ict	ASCII-ict format

Data Format and Parameters

The P-3 Meteorological and Navigation Data IMPACTS contains airborne measurements that include GPS positioning and trajectory data, aircraft orientation, and atmospheric state measurements of temperature, pressure, water vapor, and horizontal winds. The data files are in ASCII-ict format. Tables 4 describe how these measurements are organized in each file, as well as their units.

Table 4: Variable Descriptions

Column	Variable	Description	Units
1	Time_Start	Time start of data collection in seconds from midnight	s
2	Day_Of_Year	Calendar day of the year beginning January 1st	-
3	Latitude	Platform latitude in situ	Degrees North
4	Longitude	Platform longitude in situ	Degrees East
5	GPS_Altitude	Platform altitude above mean sea level	m
6	Pressure_Altitude	Platform altitude pressure in situ	ft
7	Radar_Altitude	Platform altitude above ground level in situ	ft
8	Ground_Speed	Platform ground speed in situ	m/s
9	True_Air_Speed	Platform aircraft true air speed in sity	kts
10	Indicated_Air_Speed	Platform aircraft indicated air speed in situ	kts
11	Mach_Number	Mach number	-
12	Vertical_Speed	Vertical speed	m/s
13	True_Heading	Platform true heading in situ ranging from 0-360 degrees	degrees
14	Track_Angle	Platform track angle in situ ranging from 0-360 degrees	degrees
15	Drift_Angle	Platform drift angle in situ ranging from -180 - 180 degrees	degrees
16	Pitch_Angle	Platform pitch angle in situ ranging from -180 - 180 degrees	degrees
17	Roll_Angle	Platform roll angle in situ ranging from -180 - 180 degrees	degrees
18	Static_Air_Temp	Meteorological static air temperature in situ	Degrees C
19	Potential_Temp	Meteorological potential temperature in situ	K

20	Dew_Point	Meteorological dew point temperature in situ	Degrees C
21	Total_Air_Temp	Total air temperature	Degrees C
22	IR_Surf_Temp	Meteorological Surface Temperature in situ	Degrees C
23	Static_Pressure	Meteorological static pressure in situ	hPa
24	Cabin_Pressure	Cabin pressure	hPa
25	Wind_Speed	Meteorological wind speed in situ. Limited to where Roll_Angle does not exceed 5 degrees	m/s
26	Wind_Direction	Meteorological wind direction in situ. Limited to where Roll_Angle does not exceed 5 degrees. Ranges from 0-360 degrees	degrees
27	U	East-West horizontal wind speed. Limited to where Roll_Angle does not exceed 5 degrees	m/s
28	V	North-South horizontal wind speed. Limited to where Roll-Angle does not exceed 5 degrees	m/s
29	Solar_Zenith_Angle	Meteorological solar zenith angle in situ	degrees
30	Aircraft_Sun_Elevation	Aircraft sun elevation	degrees
31	Sun_Azimuth	Meteorological solar azimuth angle in situ	degrees
32	Aircraft_Sun_Azimuth	Aircraft sun azimuth angle	degrees
33	Mixing_Ratio	Meteorological H2O mixing ratio in situ	g/kg
34	Part_Press_Water_Vapor	Meteorological partial water vapor pressure in situ	hPa
35	Sat_Vapor_Press_H2O	Meteorological saturated water vapor pressure in situ	hPa
36	Sat_Vapor_Press_Ice	Meteorological saturated ice vapor pressure in situ	hPa
37	Relative_Humidity	Meteorological relative water humidity	%

Software

These data are in ASCII-ict format, so no software is required to view these data.

Known Issues or Missing Data

There are no known issues or missing data with this dataset.

References

IMPACTS ESPO. GPS Flight Management System (GPFMS). https://espo.nasa.gov/impacts/instrument/GPFMS

IMPACTS ESPO. P-3 Orion-WFF. https://espo.nasa.gov/impacts/aircraft/P-3_Orion_-_WFF

NASA. NASA P-3B Airborne Laboratory. https://www.nasa.gov/mission_pages/icebridge/instruments/p3b.html

Related Data

All other datasets collected during the IMPACTS field campaign are considered related datasets. They can be located using the GHRC HyDRO 2.0 search tool and entering the term 'IMPACTS' in the search box.

Contact Information

To order these data or for further information, please contact:

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